

Canada's Nuclear Regulator



National Sealed Source Registry and Sealed Source Tracking System

Annual Report 2013



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National Sealed Source Registry and Sealed Source Tracking System Annual Report 2013

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National Sealed Source Registry and Sealed Source Tracking System Annual Report 2013

1. Executive Summary

This eighth annual report provides information on the registration and tracking of radioactive sealed sources in Canada through the Canadian Nuclear Safety Commission's (CNSC) National Sealed Source Registry (NSSR) and Sealed Source Tracking System (SSTS), from January 1 to December 31, 2013. A sealed source is a radioactive nuclear substance encased in a sealed capsule or in a cover to which the substance is bonded, and is used for a variety of activities, such as medical, industrial, commercial, as well as academic and research applications.

The NSSR is a CNSC-managed national database that maintains inventory information on all categories of sealed sources in Canada. It contains detailed information on high-risk sources (categories 1 and 2) and some information on moderate (Category 3) to low-risk sources (categories 4 and 5). This system, in conjunction with regulatory licensing and compliance operations, increases the safety and security of those sources. The NSSR's high-risk source tracking component, the SSTS, provides licensees and CNSC staff with an efficient, effective way to report and track the movement of high-risk sealed sources.

As a follow-up to the system redesign performed in 2012, a new version of the SSTS was released in 2013 to fully comply with the Government of Canada's requirements for online services. This was the main enhancement brought to the system in 2013.

By the end of 2013, the NSSR contained information on 66,139 radioactive sealed sources from all categories in Canada. This represented an increase of 23.3% over the previous year, mostly due to the growth in the number of manufactured sealed sources in 2013, combined with a slight increase in the number of imported sources. The SSTS was tracking 3,993 Category 1 sources and 32,466 Category 2 sources. The remaining 29,680 sources in the NSSR were in categories 3, 4 and 5, which are not subject to mandatory tracking through the SSTS but are subject to reporting under CNSC regulatory oversight (licensing and compliance). The SSTS registered 88,904 individual transactions of all types throughout the year, representing a 53.9% increase over 2012; 87.6% of them were performed through the online interface.

The CNSC monitors and tracks unplanned events involving the loss, theft and discovery of sealed sources in Canada. Sealed sources that are found in the public domain are immediately investigated, to ensure that safety and security are maintained and that the original owners responsible for the material are identified. In 2013, there were 17 reported events involving the loss, theft or discovery of sealed sources, most of them involving low-risk (categories 4 and 5) sources. There were two reported events involving Category 2 sealed sources; in both cases, the sealed sources had gone missing but there were no evidence of theft or loss, and they were both recovered the following day. In 9 of these 17 events, the sealed sources were either found or recovered. Throughout 2013, the CNSC performed 177 inspections among licensees using the SSTS, and found that 98.9% of them were compliant with their licence condition related to the tracking of categories 1 and 2 sealed sources. The CNSC ensured that the two instances of non-compliances were adequately addressed by the licensees in question. The information presented in this report indicates an ongoing commitment by the CNSC and the licensees to the NSSR and SSTS, and reflects the system's effectiveness, ensuring the safe and secure management of sealed sources in Canada.

2. Introduction

Sealed sources are radioactive nuclear substances encased in a sealed capsule or in a cover to which the substance is bonded, and are used for a variety of activities, such as medical, industrial, academic and research, as well as commercial applications. The Canadian Nuclear Safety Commission (CNSC) was the first nuclear regulator among G8 countries to develop a National Sealed Source Registry (NSSR) and to implement an online Sealed Source Tracking System (SSTS). In addition, enhanced controls were established for the import and export of high-risk sealed sources.

The CNSC manages Canada's national inventory of high-risk radioactive sealed sources by means of the NSSR. The safety and security of these sources is increased through effective control and tracking. This report provides information on the registration and tracking of high-risk radioactive sealed sources in Canada through the NSSR and SSTS systems, for the period of January 1 to December 31, 2013. The report also describes developments and improvements made to the systems during the same period.

This is the eighth annual report for the NSSR and SSTS. Previous annual reports can be found on the "[Reports on Sealed Source Tracking System](#)" CNSC Web page.

3. About the NSSR and SSTS Data

The SSTS is a secure information management computer program used to populate the NSSR, and allows licensees to report their source transfers online. The NSSR enables the CNSC to build an accurate and secure inventory of sealed sources in Canada, starting with those that are classified as high risk. The information is as current as the licence reporting allow (e.g., reporting within two days of receipt and seven days in advance of any transfer).

Sealed sources are classified by the International Atomic Energy Agency (IAEA) into five different categories (for more information on the categorization of sealed sources, consult the "[Sealed Source Tracking](#)" CNSC Web page). Categories 1 and 2 are designated as high risk (or risk-significant), Category 3 sources are designated as moderate risk, and categories 4 and 5 sources are designated as low risk. The CNSC has focused its efforts to accurately capture data about these sources, commensurate with their risk levels. Subsequently, the NSSR contains detailed information on categories 1 and 2 sealed sources in Canada, and limited information on sources in categories 3, 4 and 5. Currently, as inventory information is received from licensees through their annual compliance reports (ACRs), the data is validated for accuracy and consistency, and compiled in tables.

4. Major Developments in 2013 and Future Improvements

4.1 System enhancements

In June 2013, the CNSC released a new version of the Sealed Source Tracking System (SSTS), to fully comply with the Government of Canada's *Standard on Web Accessibility* for external-facing online applications. This followed a complete system redesign, performed in 2012.

The CNSC also implements ongoing system improvements, to address issues and ensure proper system maintenance (for example, updates to the source activity decay calculator, category identification and licence number look-up table). As enabling tools are created and modified, the internal documentation associated with the NSSR and SSTS is also revised. In 2013, the CNSC fixed an issue related to how the information was displayed for americium-241/beryllium sealed sources, updated the half-life of iridium-192 in accordance with the *Nuclear Decay Data for Dosimetric Calculations*¹ and performed some other minor improvements.

4.2 Registration of categories 3, 4 and 5 sources

The CNSC is maintaining data based on inventories submitted annually by the licensees on all categories of sealed sources used in Canada, including those of categories 3, 4 and 5. In late 2012 and 2013, the CNSC continued to develop an online system – a secure Web-based interface whereby licensees can enter and revise their inventory data in their annual compliance reports (ACRs). Three different licensed activities are currently implemented as part of this project.

In conjunction with these efforts, the CNSC is reviewing the information being collected in ACRs, to reduce and streamline the data that must be submitted. The CNSC will continue to develop the online system for other types of licenced activities, and rollout will occur gradually as development is completed. This will facilitate the eventual inclusion of all sealed source categories in the NSSR. Meanwhile – and until the online system is available – the manual entry of data on categories 3, 4 and 5 sources will continue, based on licensees' ACRs.

4.3 International presentations

In February 2013, the CNSC delivered a presentation titled “Updates on Canadian Regulatory Requirements for the Transport and Safe Handling of Radioactive Sources” at the International Source Suppliers and Producers Association (ISSPA) Workshop held in Berlin, Germany. It provided an overview of Canada’s regulatory requirements for the transport and safe handling of radioactive sealed sources, with some details about the NSSR and the SSTS.

In October 2013, the CNSC tabled *The Canadian Nuclear Safety Commission’s Experience with the Implementation of the Provisions of the IAEA Code of Conduct on the Safety and Security of Radioactive Sources and its Supplementary Guidance on the Import and Export of Radioactive Sources* at the International Conference on the Safety and Security of Radioactive Sources in Abu Dhabi, United Arab Emirates. The report summarized the CNSC’s experience on the implementation of the code and its supplementary guidance over the period 2010–12. Along with the national report, the CNSC delivered a presentation titled “Successes and Challenges in Implementing Sustainable Approaches in Canada to Strengthen the Safety and Security of Radioactive Sources”. The presentation provided an overview of Canada’s strategy for an effective regulatory oversight of sealed sources, along with details about the NSSR and recent updates to the SSTS.

¹ ICRP, 2008. Nuclear Decay Data for Dosimetric Calculations. ICRP Publication 107. Ann. ICRP 38 (3)

4.4 Outreach program

Following the launch of the redesigned version of the SSTS, in December 2012, the CNSC presented the redesign at the Industrial Radiography Working Group Meeting, held in Ottawa on March 7, 2013.

5. Performance Management

5.1 Performance measures and verification

In order to gauge the effectiveness of the SSTS program and verify the accuracy of data in the system, CNSC inspectors physically cross-reference data in the SSTS against the licensees' actual inventory of sealed sources. Routine CNSC compliance inspections include requirements to verify sealed source tracking information. Inconsistencies are immediately addressed, to ensure accuracy in the data. These inconsistencies include errors in source serial numbers and reference dates, as well as the use of non-standard terminology when identifying sealed source assemblies.

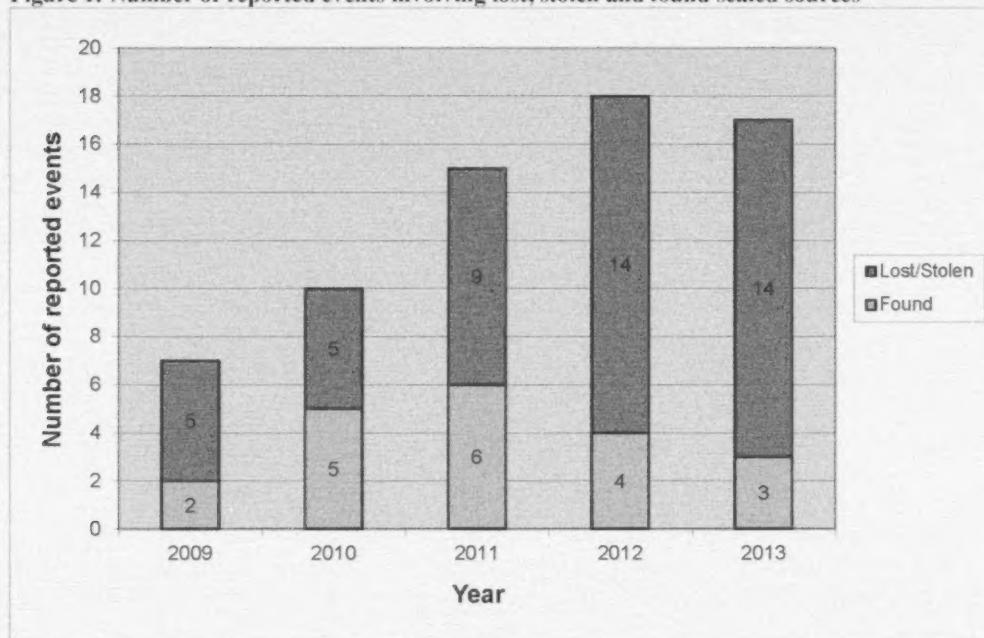
In 2013, a total of 177 inspections were performed among those licensees for which mandatory tracking of high-risk sealed sources is required as a condition of their licence. These inspections covered the accuracy of the data related to sealed source transfers within Canada, as well as the accuracy of the licensees' inventory at their location, at the time of inspection. In 2013, 175 of the inspected licensees (or 98.9%) were found to be compliant, an improvement compared to the 94.7% compliance level recorded in 2012. The non-compliances were administrative in nature, where the radiation devices were registered in the NSSR but not at the correct licensee's location. The CNSC ensured that the licensees corrected the information and implemented appropriate corrective measures.

For more information on the performance results of Canadian licensees using nuclear substances, readers are invited to consult the [annual safety performance reports](#) posted on the CNSC website.

5.2 Event mitigation

The NSSR and SSTS are essential to the maintenance of the safety and security programs for high-risk sealed sources. It is important for the CNSC to track and ensure that the licensees make all necessary efforts to mitigate the impacts of any events involving sealed sources. Current regulations require all licensees to immediately report lost or stolen nuclear substances to the CNSC, along with written descriptions of any actions taken (or proposed to be taken) to recover the missing material. All events involving sealed sources are investigated and followed-up by the CNSC, to ensure that the licensees take all the necessary actions to mitigate the impacts of the event. If an event involves the loss or theft of a sealed source or radiation device, the CNSC informs national and international stakeholders who may assist with the recovery.

Information on lost and stolen nuclear substances can be found in the CNSC's [Report on Lost or Stolen Sealed Sources and Radiation Devices](#), available on the CNSC website. The report lists all the lost, stolen and found sealed sources and radiation devices in Canada, as reported to the CNSC. As shown in Figure 1 there were 17 events involving 29 lost, stolen or found sealed sources in Canada during 2013 and more details are provided below the figure. In summary, three of these 17 events were related to the finding of sealed sources and radiation devices (shown in blue on the figure). These three events involved two Category 4 sources and three Category 5 sources. For the other 14 events, the material was recovered for six of them (two Category 2 sources and seven Category 4 sources), while six events are still under investigation (four Category 4 sources and eight Category 5 sources) and two events involving three Category 5 sources are no longer being investigated (following thorough but unsuccessful searches conducted by the licensees).

Figure 1: Number of reported events involving lost, stolen and found sealed sources

Over the reporting period:

- There were no events involving **Category 1 or 3** sealed sources.
- There were two events involving two **Category 2** sealed sources that were reported as missing. In one case, the licensee reported that an exposure device had gone missing while in transport. The exposure device was recovered the following day at the shipping company's warehouse, as the shipment had been delayed. The other event was reported following the reload of a gamma knife (a prescribed equipment used in radiosurgery). The licensee reported a missing sealed source when in fact it had been displaced inside the device. The source was recovered and properly positioned inside the prescribed equipment within a few days, following the reload.
- Nine events involved **Category 4** sealed sources. Category 4 sources are considered low risk, and are unlikely to be dangerous to persons².
 - Lost: Five events of lost sealed sources. Three of these five events involved five sealed sources which have been recovered. Each of the other two events involved a single sealed source, reported as missing following the licensees' inventory verification; the licensees are still investigating in both cases.
 - Stolen: Two events of stolen sources, each one of them involved two sealed sources. In both cases, a portable gauge (containing two sealed sources) was being stored in a vehicle that was stolen. In one instance, the portable gauge was recovered upon the vehicle's recovery, two weeks following the theft. For the second event, the vehicle was recovered but not the portable gauge; local authorities have been notified and the matter is under investigation.

² IAEA, *Categorization of Radioactive Sources*, RS-G-1.9, (2005), Table 3.

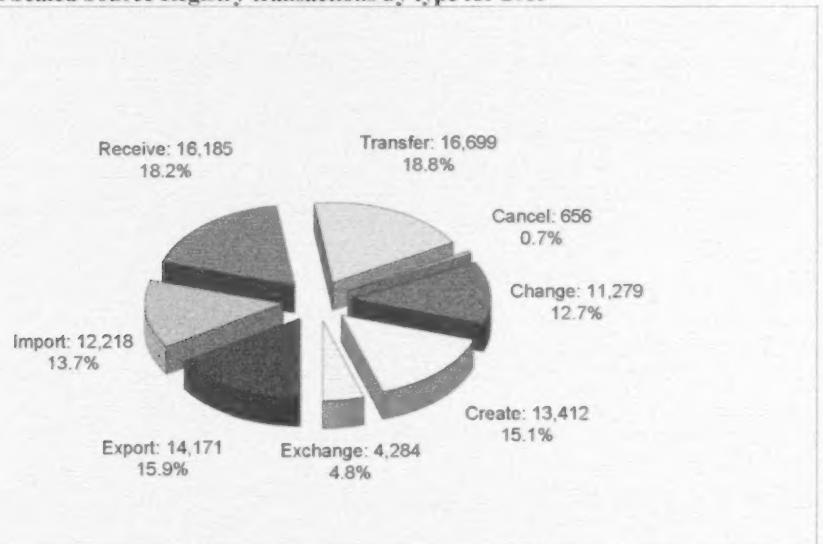
- Found: Two events, each involving a found sealed source. In both events, the sealed sources were contained in a radiation device that was found at a scrap metal recycling facility. In both cases, the original owners have been identified and have reclaimed the sealed sources which are now in secure storage at their respective facilities.
- Six events involved **Category 5** sealed sources. Category 5 sources are considered very low risk, posing no personal danger to persons (due to their low activity, short half-life or their radiological nature).
- Lost: Five events of lost sealed sources, all together involving 11 sources. In all these cases, the sealed sources have not been recovered. In one event, five check sources were lost during their transport. In another case, a licensee reported two missing radiation devices following inventory verification. Two reported events involved the loss of radiological markers (used in nuclear medicine imaging to differentiate left and right on patient images). Lastly, there was one reported event involving the loss of an iodine-125 oncoseed, used in nuclear medicine. Following a thorough search, the licensee concluded that it had likely been disposed of in regular waste. Measurements from another seed from the same batch showed that someone would have had to be within one meter of the seed for a period of 200 days to reach 1 mSv, the regulatory yearly dose limit for members of the public.
- Found: There was one event where three sealed sources were found. In this particular case, three check sources were found in a tool box at the CNSC headquarters. Neither one of them had any detectable activity, and they were properly disposed of.

6. Operational Data

6.1 National Sealed Source Registry statistics

During 2013, the NSSR continued to be populated with sealed source information for all categories, as licensees reported their transactions via the online interface or by other means (such as fax, email or written submissions by regular mail). The following operational data encompasses the entire NSSR and SSTS. Figure 2 shows all the transactions reported in 2013, which include transfers, receipts, imports, exports, cancellations, changes, creations and exchanges.

Figure 2: National Sealed Source Registry transactions by type for 2013



Types of transactions

Receive: Sources received by licensees at licensed locations.

Transfer: Sources transferred within Canada between licensees and licensed locations.

Cancel: Transaction cancelled due to unforeseen circumstances (export and shipment cancellations and delayed transfers).

Change: Data change or correction (e.g., to reference date of source activity).

Create: Creation of a new source manufactured in Canada, or recording of sealed sources in secure storage awaiting disposal.

Exchange: Replacement of one source for another in a device or prescribed equipment, at a licensed location.

Export: Sources shipped out of Canada.

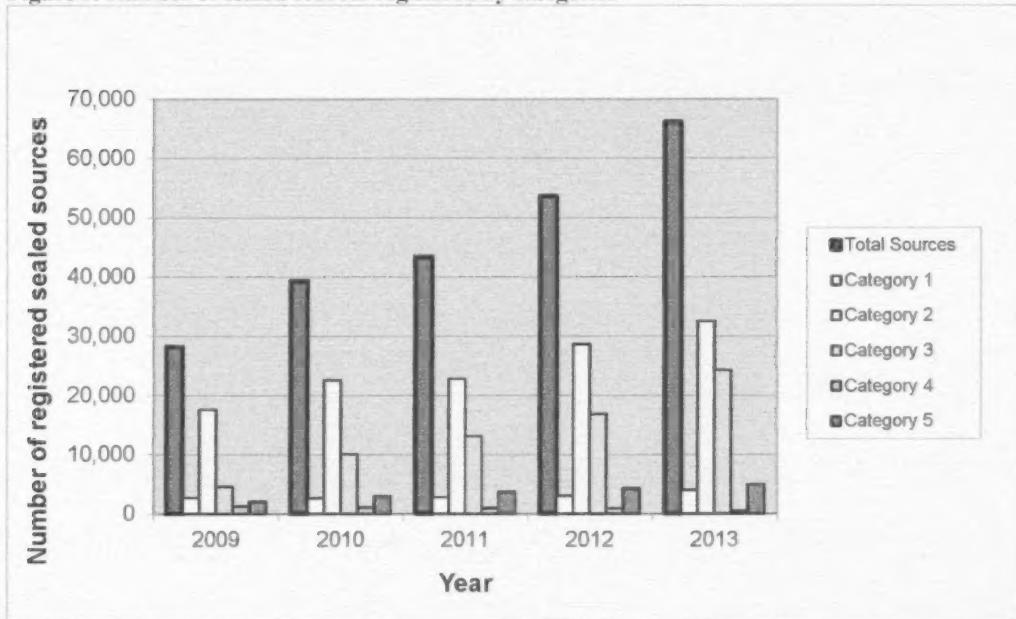
Import: Sources shipped into Canada.

Table 1 and Figure 3 show the total number of sources in the NSSR as of December 31 of each year, as well as their breakdown by IAEA category³. The number of categories 1 and 2 high-risk sources (subject to mandatory source tracking) varies with the number of sources created, imported and exported by licensees. In 2013, there was a 15.3% increase in the number of these high-risk sources when compared to 2012, primarily due to an increase in the number of sealed sources manufactured in Canada, as well as a slight increase in the number of imported sources. Furthermore, the total number of categories 3, 4 and 5 sources has continuously increased over the years, as the activity of higher-risk sources naturally decayed to lower categories.

³ IAEA, *Categorization of Radioactive Sources*, RS-G-1.9 (2005).

Table 1: National Sealed Source Registry statistics

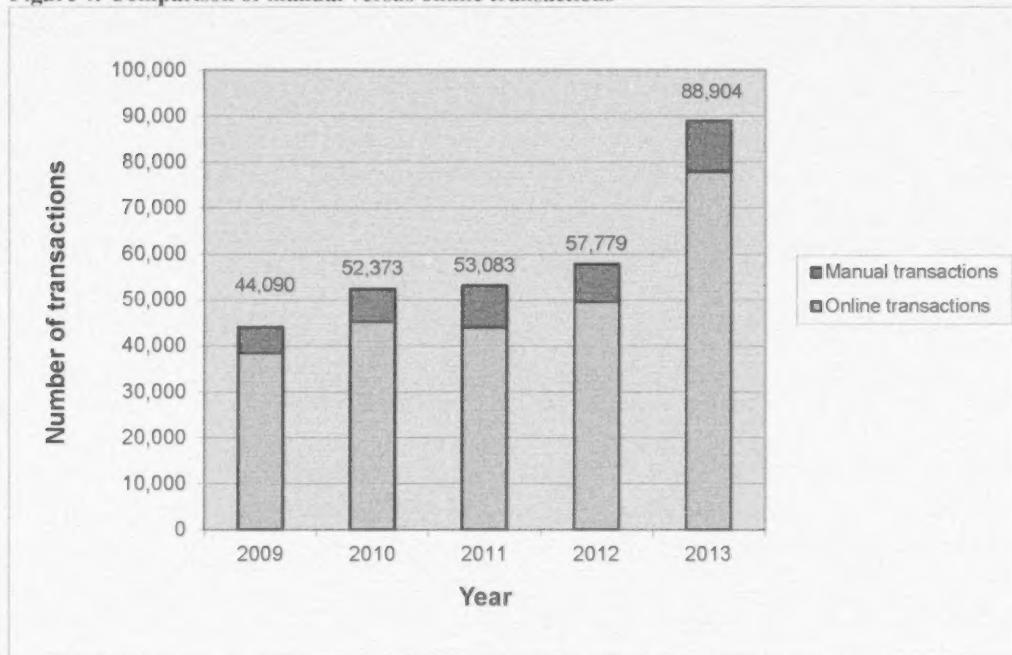
	2009	2010	2011	2012	2013
Number of sources in NSSR (all Categories) in Canada	28,132	39,263	43,371	53,660	66,139
Number of Category 1 sources tracked in Canada	2,702	2,608	2,777	3,034	3,993
Number of Category 2 sources tracked in Canada	17,530	22,541	22,778	28,585	32,466
Number of Category 3 sources recorded in the registry	4,578	10,051	13,092	16,814	24,242
Number of Category 4 sources recorded in the registry	1,263	1,094	1,006	917	484
Number of Category 5 sources recorded in the registry	2,059	2,969	3,718	4,310	4,954

Figure 3: Number of sealed sources registered by categories

6.2 Number of transactions and online usage

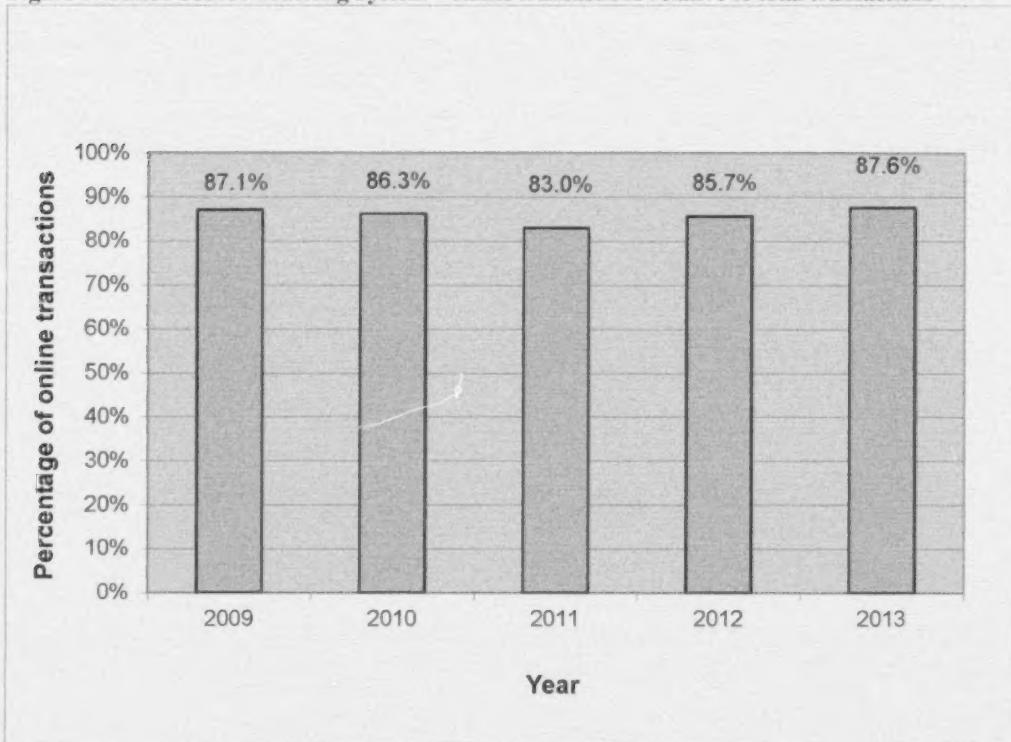
Figure 4 shows the total number of transactions, as well as the comparison of manual transactions (conducted by fax, mail and email) versus those conducted online. In 2013, there were a total of 88,904 transactions, which amounted to an increase of 53.9% from the 57,779 transactions recorded in 2012. This increase is a result of a greater number of sealed sources manufactured in Canada, and a greater number of sealed sources that licensees transferred for long-term storage.

Figure 4: Comparison of manual versus online transactions



With respect to online usage, Figure 5 shows that 87.6% of these transactions were performed via the online interface in 2013. In fact, the relative percentage of online transactions to total transactions has remained relatively stable in the past five years, following the changes implemented in 2008. There were 11,028 transactions conducted by fax, mail and email in 2013, representing a 33.4% increase from the 8,266 such transactions in 2012. This increase is a direct result of the larger number of transactions conducted in 2013, as the relative percentage of manual transactions to online transactions has remained stable.

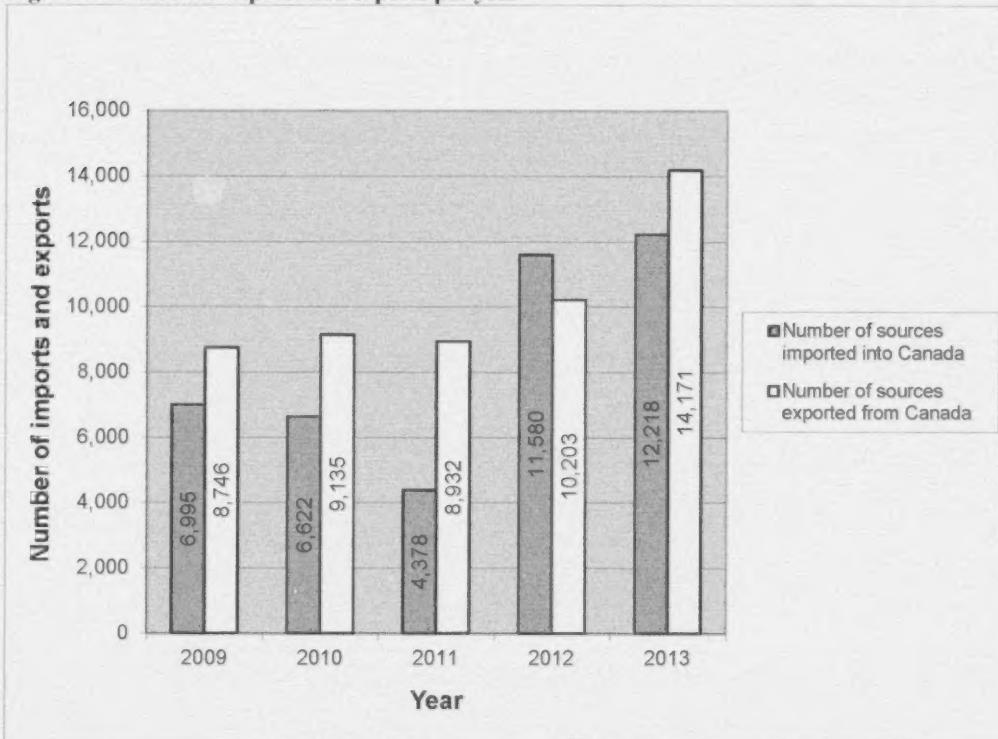
Figure 5: Sealed Source Tracking System – online transactions relative to total transactions

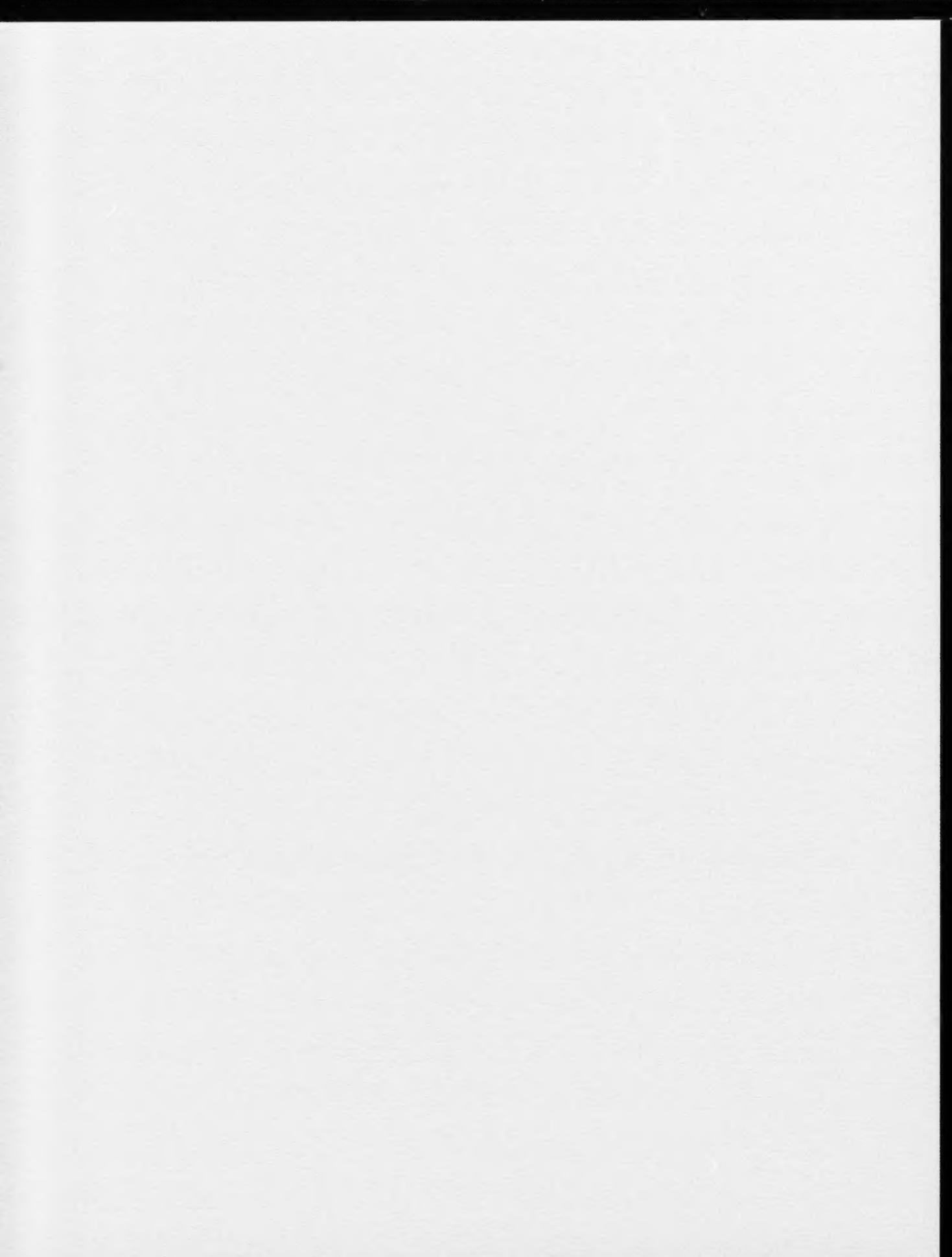


6.3 Import and export details

Figure 6 shows the number of import and export transactions in the SSTS, as of December 31 of each year. Users of nuclear substances in Canada routinely import and export sealed sources, in accordance with their licences. In 2013, there was a 38.9% increase in the number of sources exported from Canada, compared to 2012, as a result of the greater number of sealed sources manufactured in Canada.

Figure 6: Number of imports and exports per year





7. Conclusion

The NSSR and SSTS contain information on the movement and location of high-risk radioactive sources in Canada, from their manufacture to their final disposition. Among the G8 countries, the CNSC was the first nuclear regulator to implement a national registry of high-risk sealed sources and monitor their movement using an online tracking system.

A new version of the SSTS was released in 2013, to ensure full compliance with the Web accessibility requirements set for the Government of Canada's online services. Statistics show a 23.3% increase in the number of sealed sources tracked in the SSTS, when compared to 2012. Compliance inspection results in 2013 show a high level of compliance with the requirements for the tracking of high-risk sealed sources movements: 98.9% of all inspected licensees were compliant. This indicates an ongoing licensee commitment to the NSSR and SSTS, and reflects the system's effectiveness, which contributes to ensuring the safe and secure management of sealed sources in Canada.